MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

EEE7226 – QUALITY SYSTEMS AND MANAGEMENT

(MEEE)

23rd October 2018
10:00 a.m - 1:00 a.m
(3 Hours)

INSTRUCTION TO STUDENTS

1. This Question paper consists of **12** pages, including cover page and the **Appendix**, with **2** sections. Attempt **ALL** questions.
2. **Section A** consists of Multiple Choice Questions. Write your answers on the Multiple Choice answer sheet given and attach it together with your answer Booklet of **Section B**.
3. **Section B** consists of descriptive and statistical questions. Provide your solutions on the answer Booklet given. Any graphs drawn on graph papers must be attached together with the anwer Booklet.

SECTION A: Multiple Choice Questions, answer All (25 Marks)

1. The Total Cost of Quality of a product/service can be considered to consist of a few categories of cost. Internal and external failure costs are an example. Name the other(s).
   (a) Production and Management costs
   (b) ISO9001 Certification cost
   (c) Prevention and inspection costs
   (d) (a) and (c)
   (e) (a), (b) and (c)

2. Quality is:
   (a) Zero defects found
   (b) Conformance to requirements
   (c) The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs
   (d) (b) and (c)
   (e) All the above

3. The definition of quality that involves the product functioning as expected without failure is:
   (a) Performance.
   (b) Conformance.
   (c) Reliability.
   (d) Standardization.
   (e) Endurance.

4. You are the Production Manager of a manufacturing company. As part of the Quality Control process, you have decided to check 2% of the production output for environmental check. Which technique are you using?
   (a) Pareto Diagram.
   (b) Control Charts.
   (c) Statistical Sampling.
   (d) Sample Selection.
   (e) Benchmarking.

5. Which of the following is not a tool for Perform Quality Control process.
   (a) Inspection
   (b) Benchmarking
   (c) Flow charting
   (d) Histogram
   (e) Spread sheet

Continued....

6. The plan-do-study-act cycle is also known as the
   (a) TQM activity approach.
   (b) Deming cycle/wheel.
   (c) Continuous improvement cycle.
   (d) Quality circle.
   (e) Action wheel.

7. Just-in-time philosophy is applicable in all of the following, except:
   (a) Service organizations
   (b) Manufacturing organizations
   (c) Assembly line operations
   (d) Supermarkets
   (e) Education

8. One common definition of quality, which focuses on measuring how well the product or service meets its intended targets and tolerances is.....
   (a) Quality is free.
   (b) Value for price paid.
   (c) Technical perception.
   (d) Judgmental evaluation.
   (e) Conformance to specifications.

9. In six-sigma, the level of defects is reduced to approximately
   (a) 0 defect
   (b) 1.4 parts per million
   (c) 2.4 parts per million
   (d) 3.4 parts per million
   (e) 34 parts per million

10. A six sigma team has been formed to improve an existing process. Which of the following tools should the team use first to gain a clear understanding of the current process?
   (a) Flowchart.
   (b) Pareto chart.
   (c) Process FMEA.
   (d) Taguchi Loss Function.
   (e) Check sheet.

11. When analyzing quality for a project, as the Project Manager you decide to use a tool. This tool provides a creative way to look at the causes or potential causes of a problem. Which tool are you planning to use?
   (a) Pareto analysis.
   (b) Control chart.
   (c) Statistical sampling.
   (d) Ishikawa diagram.
   (e) Flow chart.

Continued....

Questions 12 – 14 refer to the following information.

High Precision Ltd has a contract with OEM Bhd that requires semiannual, destructive testing of sample products. According to the contract, test results must be submitted to the customer to retain qualified supplier status, and the supplier must notify the customer when any of the samples fail testing. During a test cycle, some of the products fail, and the quality manager directs the quality engineer to reduce the number of samples tested by the number that failed so that the records will show that all samples passed the tests. The quality engineer documents the manager's orders, changes the test records, and ships the product. A short time later, both the quality engineer and the quality manager are laid off during a reorganization. Upper management subsequently hires a new quality engineer and contracts with an outside audit company to conduct an audit. In preparing for the audit, the new quality engineer discovers the falsified records.

12. What immediate action should the first quality engineer have taken after documenting the test failures?
    (a) Placed all products on hold and did a corrective action .
    (b) Had the test repeated by an external testing laboratory.
    (c) Negotiated a revised specification with the customer.
    (d) Retrained the employees who tested the products.
    (e) Had the failed samples reworked and retested.

13. How should the first quality engineer have responded to the quality manager's order?
    (a) Carried out the directive exactly as ordered.
    (b) Instructed someone else to perform the task.
    (c) Advised the manager of their potential adverse consequences.
    (d) Notified the customer anonymously.
    (e) Carried out a second test to confirm the first test results.

14. With respect to the falsified records, the new quality engineer is responsible for
    (a) Documenting as historical any events that took place prior to being hired at this company.
    (b) Documenting the impact those records will have on future product.
    (c) notifying management and recommending that the customer be contacted promptly.
    (d) Re-running the tests to see whether similar failures Occur.
    (e) Initiating an immediate conformance audit of the production process.

15. The following quality gurus are matched with their best known contributions to quality, except
    (a) Walter Shewhart – PDCA cycle
    (b) Kaoru Ishikawa – Cause and Effect diagram
    (c) Deming – 14-Points for management
    (d) Philips Colby – quality is free
    (e) Joseph Juran – Juran Methodology

Continued....

16. In statistical quality control, variation in the production process leads to:
    (a) Quality defects.
    (b) Process improvement opportunities.
    (c) Quality improvements.
    (d) Product consistency.
    (e) Service improvements.

17. In statistical process control, what measures the central tendency of a set of data?
    (a) Coefficient of variation
    (b) Variance
    (c) Standard deviation
    (d) Mean
    (e) Range

18. What are the four most common control charts?
    (a) x-bar, R, p, c
    (b) x-bar, R, p, OC
    (c) x-bar, R, c, OC
    (d) x-bar, p, c, OC
    (e) R, p, c, OC

19. Upper and lower control limits of variable and attribute control charts are usually set at ± how many standard deviations from the mean?
    (a) 0.5
    (b) 1.0
    (c) 2.0
    (d) 3.0
    (e) 6.0

20. For the standard normal distribution, how much confidence is provided within 3 standard deviations above and below the mean?
    (a) 97.22%
    (b) 95.44%
    (c) 99.74%
    (d) 99.87%
    (e) 90.00%

21. For the standard normal distribution, how much confidence is provided within 2 standard deviations above and below the mean?
    (a) 97.22%
    (b) 95.44%
    (c) 99.74%
    (d) 99.87%
    (e) 90.00%

Continued....

22. The Six Sigma approach is normally organized around a _____ plan known as _____.
    (a) four step, PDAC
    (b) four step, DMAC
    (c) five step PDACR
    (d) five step DMAIC
    (e) five step, DMCRA

23. In six-sigma programs, individuals who have extensive training in the use of technical tools and are responsible for carrying out the implementation of Six Sigma are the _____.
    (a) black belts
    (b) green belts
    (c) blue belts
    (d) red belts
    (e) white belts

24. For consumer products, an increase in the percentage of returned goods, most likely equates to an increase in _____.
    (a) Product not meeting specifications
    (b) End-user dissatisfaction
    (c) Internal reject rates
    (d) Nonconforming material costs
    (e) Nonconforming cost of quality

25. In SPC, p-chart is used to monitor the manufacturing process when
    (a) Only the number of defective items is known, but not the total samples.
    (b) The number of defective items and the total number of samples are known.
    (c) Changes in the mean of measured samples are to be monitored.
    (d) The standard deviation or variability of measured samples is to be monitored for improvement purposes.
    (e) Control charts for variables are not available.

Continued....

SECTION B

Question 1

(a) As exemplified in the criteria for the Malcom Baldrige Quality Award, where leadership is given the highest point, describe why leadership is considered to be a crucial element in any change management and highlight its impacts in quality management programme. [5 marks]

(b) Joseph Juran's is well remembered for his contribution in process improvement methodology, which is an important concept in continuous improvement philosophy.

(i) Name this methodology and highlight its main components. [4 marks]

(ii) With the help of a proper diagram, describe how these components inter-relate with each other and how this inter-relationship embody the concept of continuous improvement. [7 marks]

(iii) For each of these components, describe its objective(s) and the activities(s) involved in realising this/these objective(s). [9 marks]

Question 2

(a) One of the fundamental principles of Total Quality Management is the need to recognise that an activity is a *process*.

(i) With the help of a suitable diagram, show how the role of a process owner of an organisation changes from a *customer* to a *supplier*. [4 marks]

(ii) Show how the model drawn in Question 2(a)(i) links a supplier of the organisation with its eventual customers. [4 marks]

(b) There are two main aspects of implementing the Six Sigma Concept. The first is the use of technical tools and the second is people involvement.

(i) What are these tools and what is/are the main objective(s) of using these tools? [4 marks]

(ii) In terms of Six Sigma training and knowledge level, describe how people are classified. [4 marks]

(iii) The Six Sigma approach is organised around a plan known as the DMAIC. Using an appropriate diagram, describe what this DMAIC is and show how this concept and its steps are used continuously to search for quality improvement of manufactured products. [4 marks]

Continued....

(c) The Bathtub Curve can be used to describe the relative failure rate or reliability of a population of products over time. Sketch a typical Bathtub Curve by showing its components and explain how the curve describes infant mortality, constant failure and end-of-life of a product. [5 marks]

Question 3

(a) A company that manufactures lubricants has initiated a company-wide Six-Sigma initiative to improve the quality of its bottling operation. A Quality Audit team led by a Master Blackbelt has been formed, whose responsibility includes validating the quality assurance process by doing technical inspections. For the last two weeks, the Audit team has taken a daily sample of 4 semisynthetic lubricant, to determine the measurement compliance. The data and the computed means of the rod are as shown in Table Q3. Assume that he standard deviation of the population sampling is 1.62ml.

(i) Complete **Table Q3** by calculating the remaining sample mean and mean range of the samples [4 marks]

(ii) Develop the control limits of 3 standard deviations for both x-bar chart and R-chart of the manufacturing operation. [6 marks]

Sample Number	**Lubricant Content/Bottle (ml)**				**Mean (ml)**	**Range (ml)**
	1	**2**	**3**	**4**	$\bar{X}$	**R**
1	99.60	99.85	98.91	95.91	98.57	3.94
2	99.42	98.67	101.86	99.86	99.95	3.19
3	100.22	96.22	96.35	99.04	97.96	4.00
4	98.96	97.89	100.21	97.58	98.66	2.63
5	99.13	97.76	99.51	101.38	99.45	3.63
6	100.03	101.53	99.03	98.47	99.76	3.06
7	97.59	96.15	99.03	100.71		
8	100.51	97.38	97.82	97.01		
9	99.99	97.12	101.62	97.68		
10	100.15	98.22	99.09	98.34		
11	98.13	101.69	99.69	100.81		
12	96.83	99.58	97.58	96.83		
13	100.03	95.84	97.53	101.53		
14	100.76	97.76	100.76	100.39		
Mean					$\bar{\bar{X}}=$	$\bar{R}=$

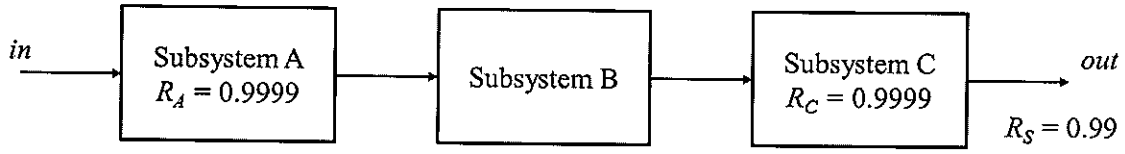
Table Q3

Continued....

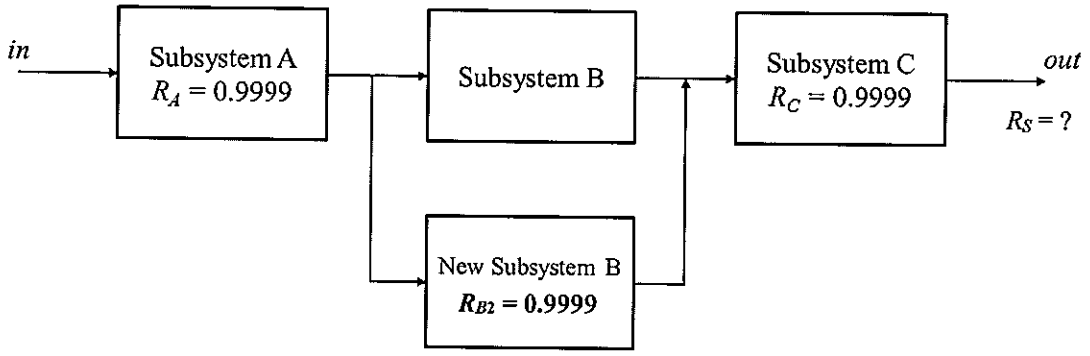
(iii) Plot the x-bar chart showing both UCL and LCL lines. For a reasonably sized chart, limit your y-axis between 94ml and 102ml. Give comment whether or not the production process is stable. [5 marks]

(iv) Plot the R-chart graph showing UCL and LCL lines. Comment whether or not the production process is stable and give advice. [5 marks]

(b) For a production system represented by the diagram below, calculate the reliability of Subsystem B if the overall reliability of the production system, R_S is estimated to be 0.99. [2 marks]



To improve the reliability of Subsystem B, a similar subsystem with a reliability figure of 0.9999 is connected in parallel as shown below. Calculate the new reliability of the entire system. [3 marks]



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Appendix

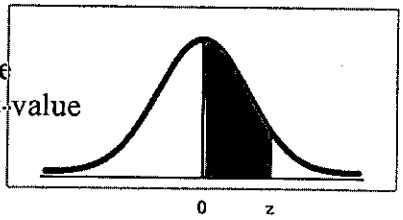
Relevant Equations

1	$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$	$\sigma_{(x)} = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}$	$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$
2	$\mathrm{UCL}_{(\bar{x})} = \bar{\bar{x}} + z\sigma_{\bar{x}}$	$\mathrm{LCL}_{(\bar{x})} = \bar{\bar{x}} - z\sigma_{\bar{x}}$	$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$
3	$\mathrm{UCL}_{(R)} = \bar{\bar{x}} + A_2\bar{R}$	$\mathrm{LCL}_{(R)} = \bar{\bar{x}} - A_2\bar{R}$	-
4	$\mathrm{UCL}_{(R)} = D_4\bar{R}$	$\mathrm{LCL}_{(R)} = D_3\bar{R}$	-
5	$\mathrm{UCL}_{(P)} = \bar{p} + z(\sigma_p)$	$\mathrm{LCL}_{(P)} = \bar{p} - z(\sigma_p)$	$\sigma_p = \sqrt{\frac{\bar{P}(1-\bar{P})}{n}}$
6	$\mathrm{UCL}_{(c)} = \bar{c} + z\sigma_c$	$\mathrm{LCL}_{(c)} = \bar{c} - z\sigma_c$	$\sigma_c = \sqrt{\bar{c}}$
7	System Reliability	$R_{SP}(t) = 1 - \prod_{i=1}^{n}[1 - R_i(t)]$	$R_{SS}(t) = R_1 \times R_2 \times R_3 \times .....R_n$

Table of Factors for 3-Sigma Control Limits of *x*-chart and *R*-chart

Observations in Sample (n)	D_3	D_4
2	0	3.267
3	0	2.574
4	0	2.282
5	0	2.114
6	0	2.004
7	0.076	1.924
8	0.136	1.864
9	0.184	1.816
10	0.223	1.777
11	0.256	1.744
12	0.283	1.717
13	0.307	1.693
14	0.328	1.672
15	0.347	1.653

TABLE A: The STANDARD NORMAL DISTIBUTION Table
"Cell" entries are areas under the N(0,1) curve between 0 and the z-value



NOTE: In calculating a z-value before entering these tables, always round correctly to two places of decimal.

0.0000	0.0000	0.0100	0.0200	0.0300	0.0400	0.0500	0.0600	0.0700	0.0800	0.0900
0.0000	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1000	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2000	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3000	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4000	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5000	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6000	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7000	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8000	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9000	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0000	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1000	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2000	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3000	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4000	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5000	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6000	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7000	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8000	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9000	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0000	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1000	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2000	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3000	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4000	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5000	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6000	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7000	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8000	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9000	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0000	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

Template for Question 3(a)

(To be stapled together and submitted with the answer script, if used)

Student ID: | | | | | | | | | | |

Sample Number	Lubricant Content/Bottle (ml)				Mean (ml)	Range (ml)
	1	2	3	4	$\bar{X}$	R
1	99.60	99.85	98.91	95.91	98.57	3.94
2	99.42	98.67	101.86	99.86	99.95	3.19
3	100.22	96.22	96.35	99.04	97.96	4.00
4	98.96	97.89	100.21	97.58	98.66	2.63
5	99.13	97.76	99.51	101.38	99.45	3.63
6	100.03	101.53	99.03	98.47	99.76	3.06
7	97.59	96.15	99.03	100.71		
8	100.51	97.38	97.82	97.01		
9	99.99	97.12	101.62	97.68		
10	100.15	98.22	99.09	98.34		
11	98.13	101.69	99.69	100.81		
12	96.83	99.58	97.58	96.83		
13	100.03	95.84	97.53	101.53		
14	100.76	97.76	100.76	100.39		
Mean					$\bar{\bar{X}}=$	$\bar{R}=$